

# Review of VELO

*Local application*

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The Linac beam energy is adjusted to keep a measured beam velocity signal constant. This adjustment is made by local application VELO running in node061E, where a beam velocity signal is available. To adjust the Linac energy, a setting message is sent to node0737, where the Linac klystron# phase channel resides, which is in turn monitored by KRFP to adjust the hardware.

The velocity signal in node061E is calculated by BPMR, which averages a 10 MHz digitized velocity waveform over part of the Linac beam pulse. (To sense the presence of actual Linac beam, a beam intensity signal is monitored during the same part of the beam pulse to confirm that each digitized point averaged corresponds to sufficient beam intensity. Without beam present, the velocity signal is invalid.

Local application VELO monitors beam pulses, which are defined as those for which event 0x10 applies, which means all HEP beam pulses, but not Linac study pulses. For each beam pulse in a series of cycles, it sums the average velocity reading furnished by BPMR. When a non-beam pulse is reached, it uses the resulting average velocity to subtract a reference velocity that is found as the "setting" of the D4VELO velocity channel. This difference is multiplied by a gain constant, currently set at -1.208, and the result is used as an adjustment in degrees for the klystron# 7 phase, C7PHAS. To avoid erratic behavior, the amount of each adjustment is limited to 0.1 degrees. Since the least bit for C7PHAS corresponds to 0.0175 degrees, the allowed range of adjustments, in raw units absolute value, is 0x0001-0x0005. Any fractional residual adjustment is retained for use as a basis in building the next adjustment.

Although BPMR requires a significant beam presence, VELO does not. If BPMR does not see enough beam, it does not update its beam velocity result D4VELO. But VELO does not know that, so it accepts the last measured velocity value again. One way this could be changed is to have VELO also monitor the count of "good points" that BPMR puts out as a diagnostic. (This count is the number of digitized beam presence that exceeded a threshold.) It could require this to be above a certain minimum in order to qualify the velocity result. If VELO determines it is not good enough, then it could ignore the velocity reading for that cycle. When it reaches a non-beam cycle, if no velocity data has been summed, it will not try to make any phase adjustment. This would ensure that VELO does not react to invalid velocity values.

Another change to VELO might include a diagnostic log of adjustments, perhaps only logging those that exceed 0x0001 in absolute value. In this way minimal adjustments of one least bit would not be included in the log.